Update on

Interim Guidance for Evaluating Subsurface Vapor Intrusion

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RATS Annual Meeting

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Purpose of today's Discussions

- Review the History of vapor intrusion issue
- Provide an Update of current status
- To make the best guidance possible:
  - by reviewing what this guidance is (and is not)
- To receive comments on tech. & policy issues
  - in today's discussions
  - during on-going OSWER and CA EI conf. calls
  - in written formats prior to, or in response to, Fed. Register notice (expected early summer)

History

Many important events lead to where we are:

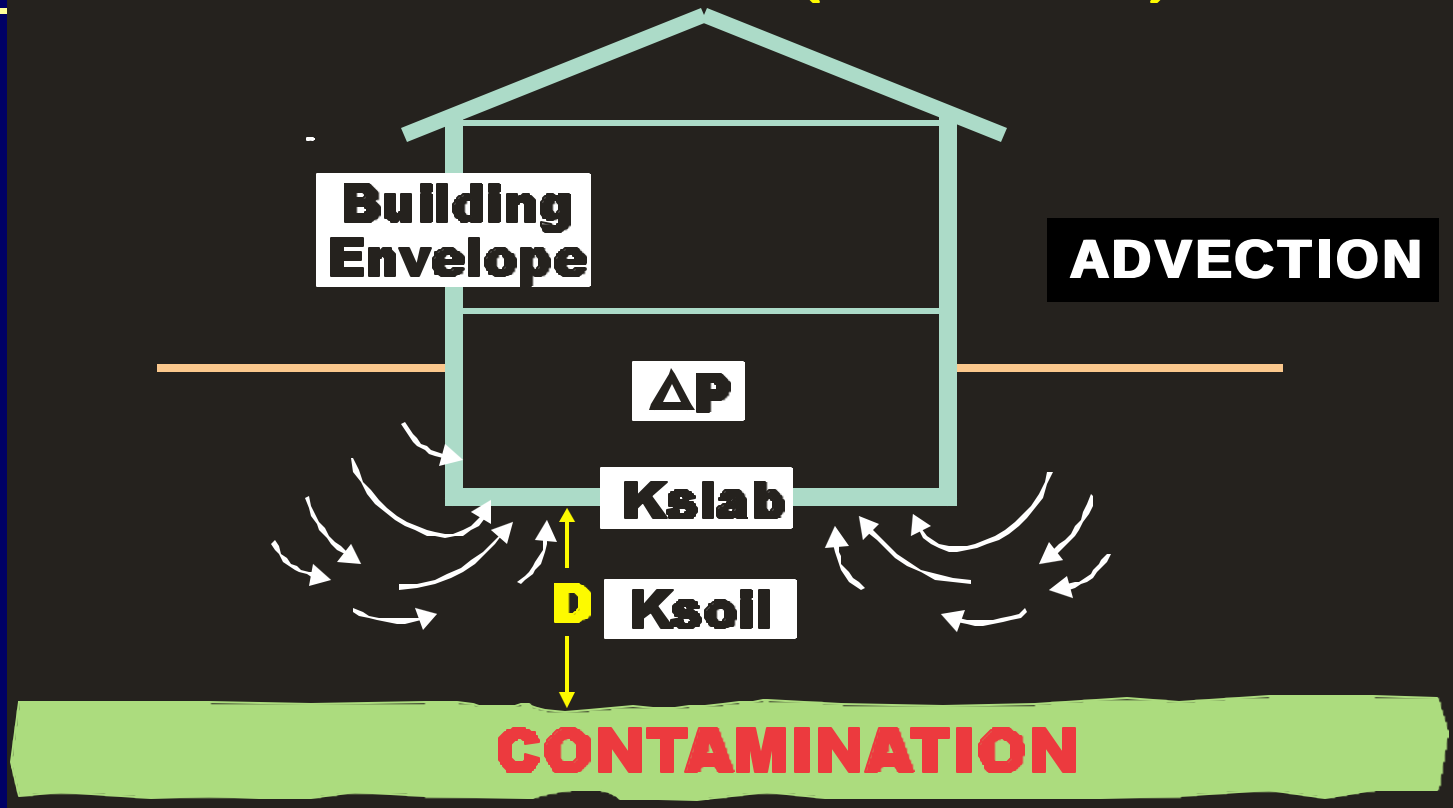
- 1803 Dr. Henry's Law - volatilization of solutes
- 1987 Soilgas tracking plume & radon entry GWMR
- 1989 J. Fitzgerald of MADEP uses OVA inside
- 1990 MA leads nation in responsible treatment
- 1991 Johnson & Ettinger's model published
- 1996 CTDEP finalizes numerical standards
- 1997 Superfund web site with user-friendly J&E
- 1998 API and ASTM issue guidance doc. w/ J&E
- 1999 Many states working on the issue, w/ regs.
- 1999 C. Johnson of Colo. DPH&E presents at Nat.
- 1999 RCRA CA EI guidance issued - freq.footnote
- 1999-00 10-Reg. RCRA CA Workshops w/ vapors

History cont.

Many important events lead to where we are:

- 2000 2-day EI Forum (www.clu-in.org/EIForum2000)
- 2001 2-day Vapor Summit (kick off to guidance)
- 2001 10/23/01 Draft Supplement to EI guidance
  - www.epa.gov/correctiveaction
- Denver Post interviews AA Marianne Horinko
  - Marianne acknowledges volatilization phenomenon
- 2002 2+day Nat. Mtg (www.clu-in.org/EIVapor2002)
- Series of Denver Post articles:
  - Critical of Johnson & Ettinger model (false-negative rates)
  - Recommending Indoor Air sampling (ignoring indoor sources)
- AA - any guidance be for "One Cleanup Program"
- OSWER Immediate Office facilitates revisions
- Simultaneous FR notice comment period and peer review

BUILDING FOUNDATION & SUBSOIL COMPARTMENT (Near-field)



CONTRIBUTION OF ADVECTIVE FLUX TO VOC INTRUSION GREATEST WHEN

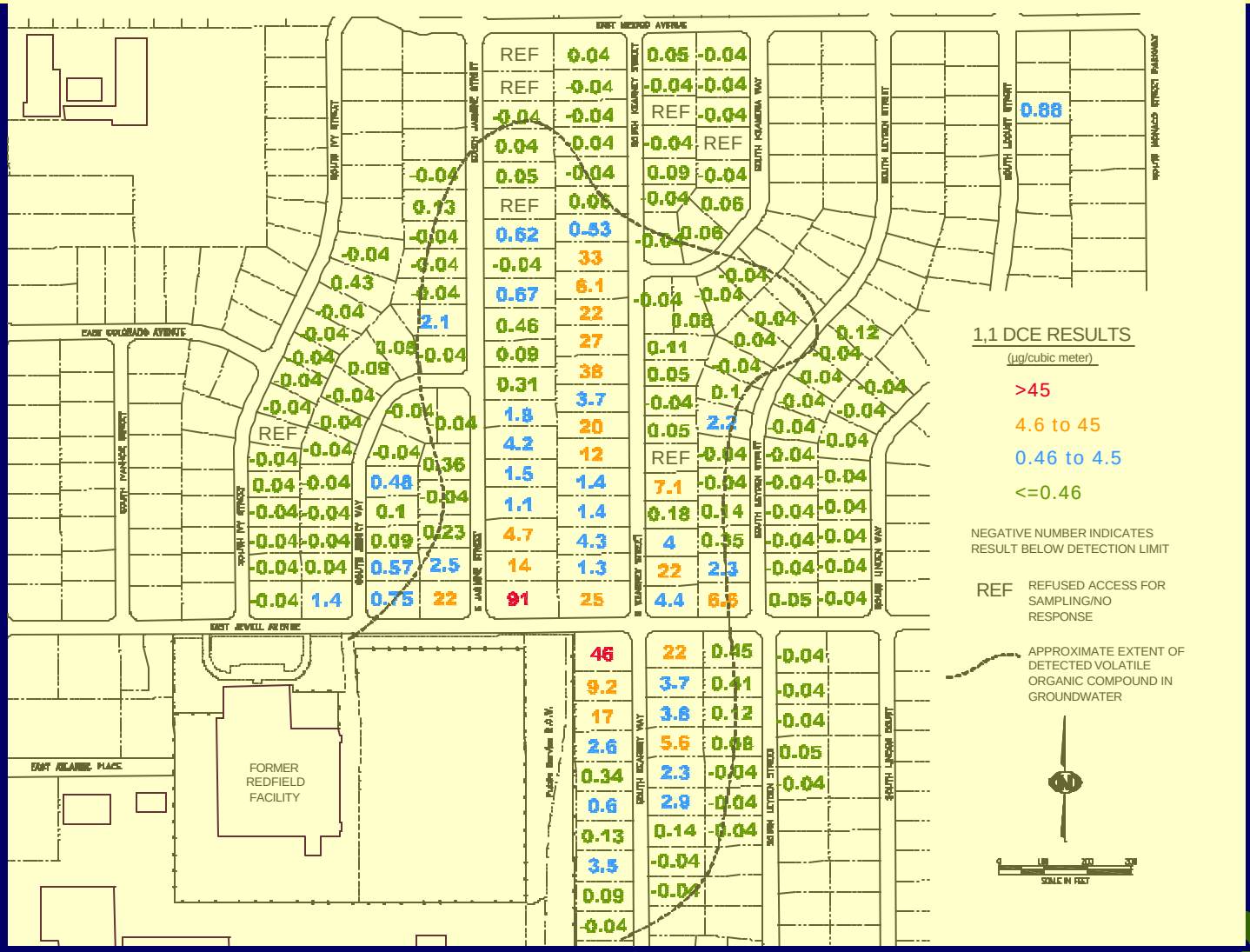
- ΔP, Ksoil, Kslab, high
- D low
- Tight above-grade building envelope

Colorado sites break 3 Myths

- **No basements**
  - slab on-grade (crawl spaces)
- **Not PPM concentrations**
  - drinking water levels
- **Not shallow groundwater**
  - 20-30 ft bgs

- Many thousand high-quality indoor air (and groundwater) data points
- Unique subsurface tracer compound 1,1-DCE
  - Not known in products (esp. correlating w/ groundwater)

1,1 DCE

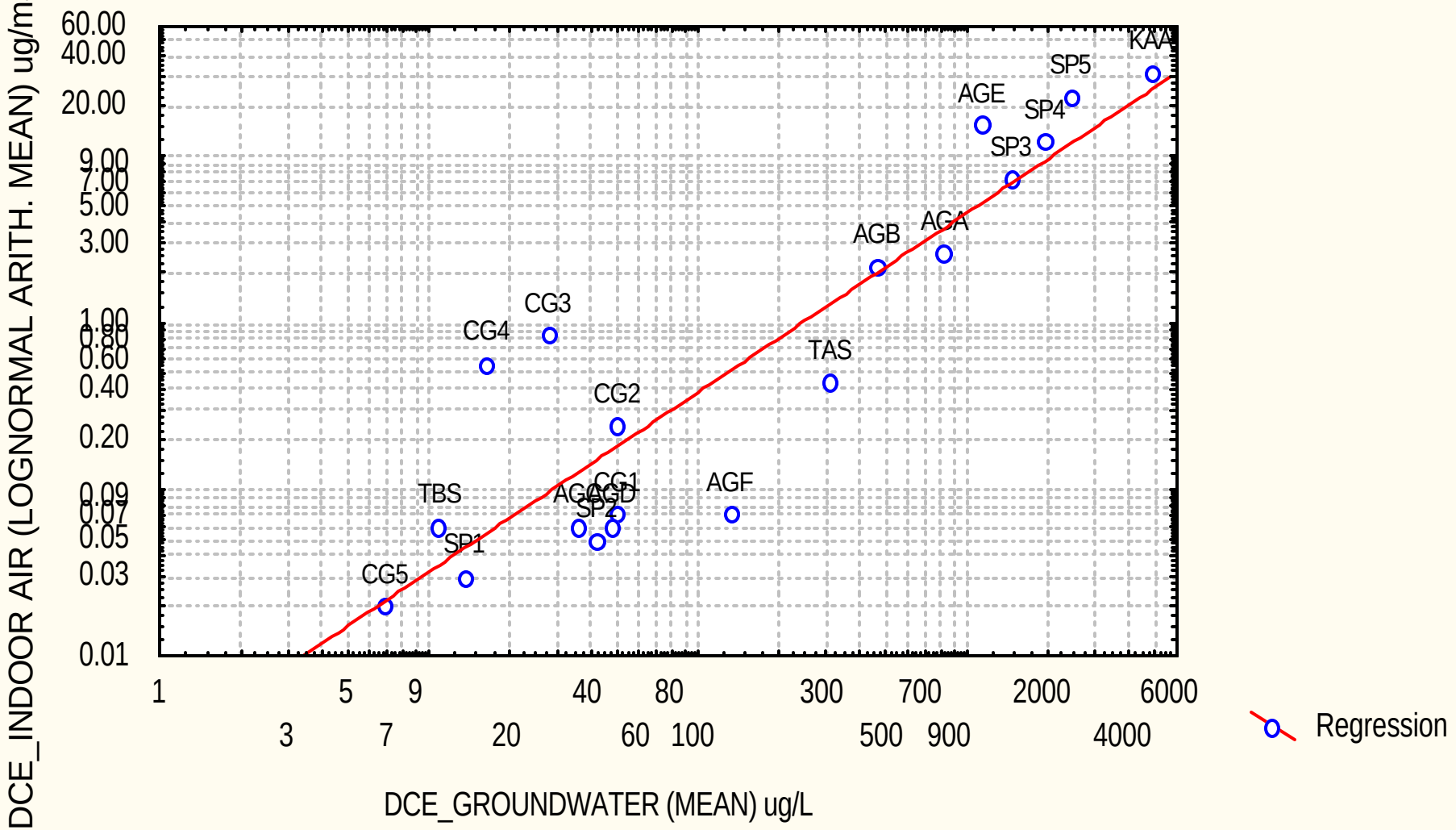

EAST COLORADO AVENUE
EAST JEWELL AVENUE
EAST ALAMEDA PLACE
FORMER REDFIELD FACILITY
1,1 DCE RESULTS
(µg/cubic meter)
>45
4.6 to 45
0.46 to 4.5
<=0.46
NEGATIVE NUMBER INDICATES RESULT BELOW DETECTION LIMIT
REF
REFUSED ACCESS FOR SAMPLING/NO RESPONSE
APPROXIMATE EXTENT OF DETECTED VOLATILE ORGANIC COMPOUND IN GROUNDWATER
SCALE IN FEET

DCE_GROUNDWATER vs. DCE_INDOOR AIR (NEAR & MID PLUME APARTMENTS)

DCE_IA = -.0549 + .00705 * DCE_GW

Correlation: r = .95977

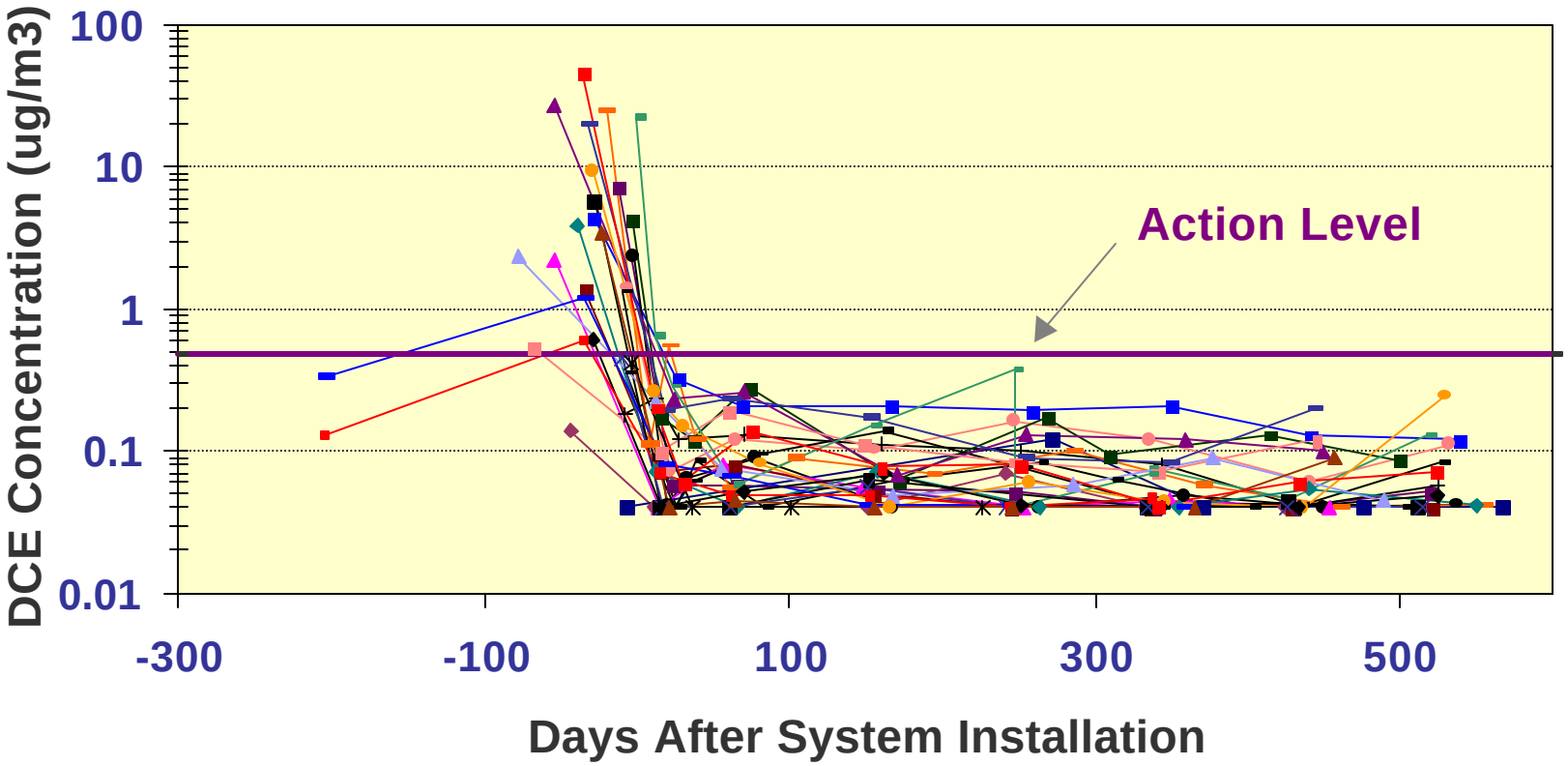
DATA THOUGH JAN 1998



SUB-SLAB SYSTEM PERFORMANCE

(typical system cost = 1 indoor air sample)

NO MODIFICATIONS REQUIRED



Why all the concern with Vapor Intrusion into Indoor Air?

- Risks may exceed those due to exposures traditionally considered in cleanup programs*, such as:
  - Ingestion of contaminated groundwater
  - Ingestion and/or dermal contact with soil

  - For example, even if only 5 ug/m3 & (MCL 5) ug/l:
  - Magnitude of vapor intrusion exposures are 10 x higher (due to inhalation of 20 m3/day vs <2 l/day)
  - Frequency of vapor intrusion exposures may be >10 x more common (based on few sites to-date)

*(However, may not exceed everyday exposures from "background" concentrations due to everyday activities and consumer products).

Background on Indoor Air & RCRA EI

RCRA Corrective Action (CA) Environmental Indicators (EI)

- Environmental Indicators (EI) are how we measure progress (using 2/5/99 Guidance)
- Q3 of EI Guidance asks "*complete pathway*"?
- Indoor air is only one of 7 media, & 3/32 of contaminated-media & receptor matrix
- But also; one of the most difficult exposure pathways to be assessed for "*completeness*":
  - Is there a potential problem?
  - Do we need to collect additional data to assess?
  - Do we need to collect indoor air samples?
  - What do the indoor air results mean?
  - *Is pathway complete in 1 or more buildings?*

2001 Vapor Intrusion Guidance
(Draft-for-Comment Version (10/23/01))

- Supplemental guidance for Ques. 3 of (2/599) EI Guidance "completeness" matrix
  - Are there concentrations of concern at the body?
- State of the Art/Science (P. Johnson, et. al.)
- EI-like (7Q), flexible, yet scientifically rigorous
  - Highlights latest scientific thinking (...to be proven)
  - Residential-based analysis (open to workers?
- Starting from the outside (source) & working in (towards indoor air)
- Trying to remove as many *sites* as possible
  - as soon as responsibly possible

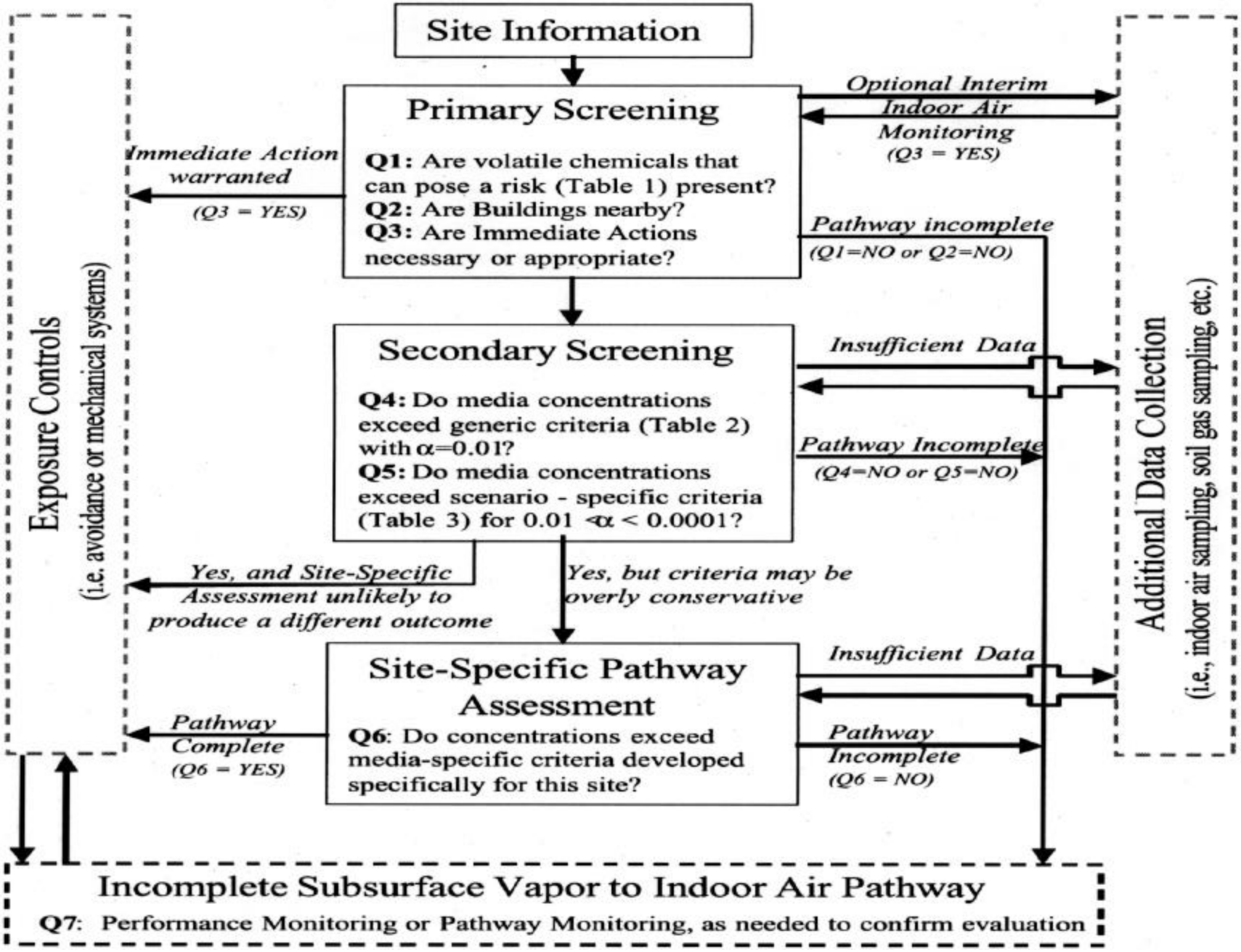
3+ Tiers of screening:

(Draft-for-Comment Version (10/23/01)

- **1-Primary**
  - obvious problem no use studying it too much
- **2-Secondary**
  - empirical observation-based attenuation (alpha)
- **3-Site-Specific**
  - models (such as J&E, with site-measured inputs)

- **+ Cap - Sample indoor air if > 10E6 x target**
  - **if conc. at source is est. > 10E6 x target and you can't find <u>any*</u> data to show pathway is not complete; then go inside**
  - *(including sub-slab vapor samples - best subsurface sample)

EVALUATING THE VAPOR INTRUSION TO INDOOR AIR PATHWAY



Modeling Controversy

Focused on Johnson & Ettinger "model"

- News media exaggeration of:
  - modeling errors (when used, results, applications)
  - over-simplification of indoor air sample meaning
    - completing ignoring indoor samples starts new study of source
- J&E equation similar to addition model
  - you get out what you put in (inputs matter)
  - model "results" (w/o all inputs) are meaningless
  - J&E has some construction limitations (screening)
  - inappropriate use not fault of model (too easy?)
  - screening needed, reasonable tool w/ typical data
  - missing data should be replaced with protective defaults (e.g., like those in Q5 & should = SF web)
  - more direct evidence needed to validate prediction

OSWER Guidance Objectives and Purpose

3/27 Summit - Look forward - Using best available science

- Prevent adverse health effects = bottom line
- Reduce vapor intrusion exposures, by:
  - considering pathway on par with others (concept)
  - provide practicable guidance that can/will be used
  - national benchmark that is fair, practical, and technically defensible
- Efficiently screens all potential *sites* (to remove as many *sites* as resp possible ASAP
  - have a low false negative rate (at each tier)
  - flexibility to allow but not require higher tier screen
  - allows predictions to be verified and documented
  - provide incentives to protect human health as cost effectively as possible

OSWER Guidance - One Cleanup Program

Special Issues for Risk Assessors

- Objective - Protect populations by:
  - Efficiently screening all potential *sites* (to remove as many *sites* as responsibly possible ASAP
- If pathway "complete"* in 1 or more buildings
  - w/ generic exposure scenarios (e.g., R3's RBCs)
  - (It is not appropriate to vary exposure factors here)
  - Full delineation of affected bldgs needed
    - Delineation methods to be added to guidance (?)
  - Variation in exposure factors should be bldg-specific and only with notification of occupants
    - for RCRA EI detailed exposure analysis (i.e. variations in exposure factors) are to be documented on 2/5/99 forms (Questions 4 and/or 5)

Summary of proposed edits
OSWER-wide One Cleanup Program

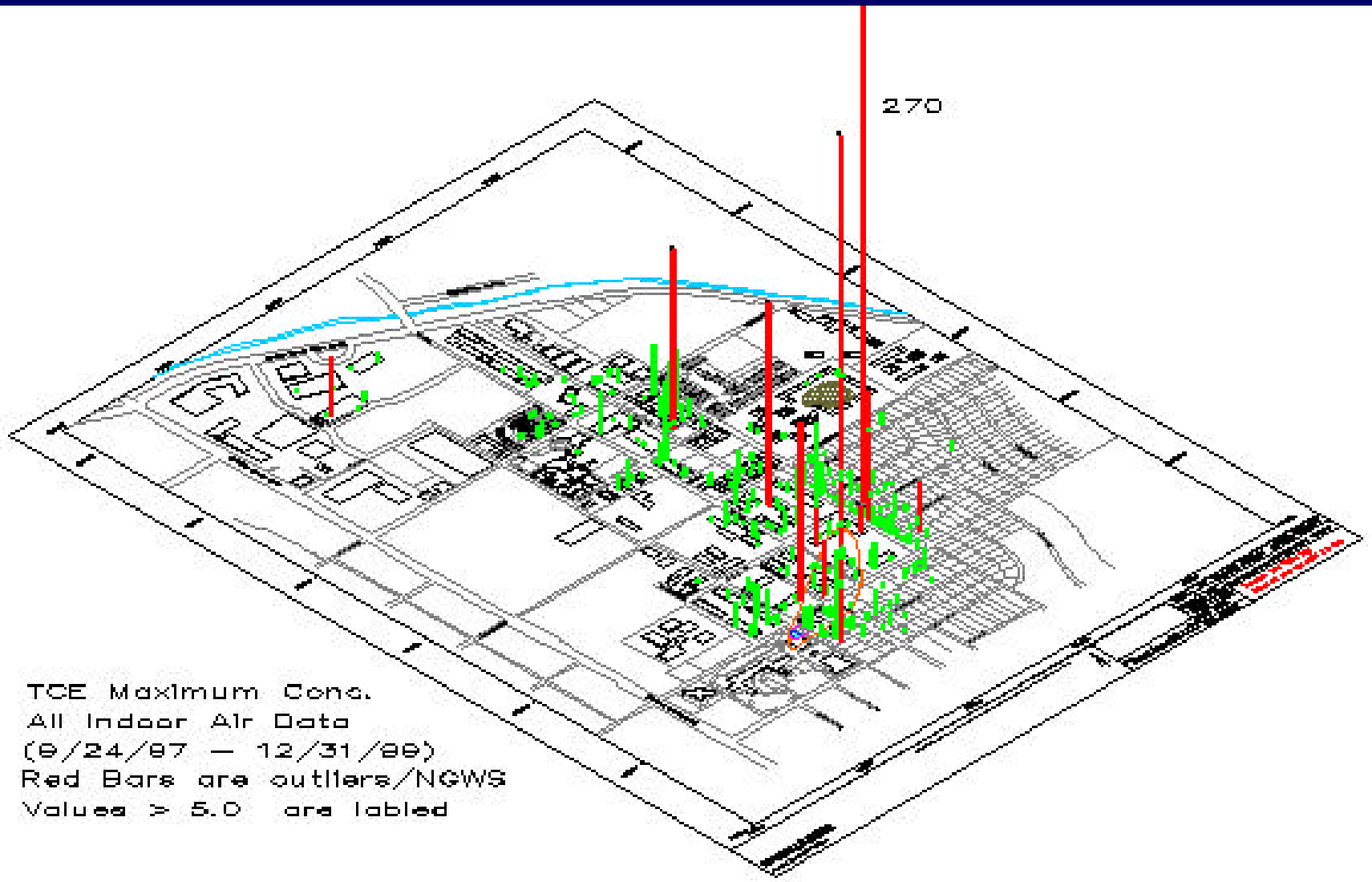
- Evaluating the Subsurface Vapor Intrusion Pathway: Interim Guidance for Cleanup Programs
- Exclusionary Criteria (Q4a, Q5a)
  - preventing application of generic modeling
  - pushes site to Question Q6
- Question 6 now recommends Sampling:
  - Sub-slab
  - Crawlspace
  - Indoor Air (& distinguish that from subsurface?)
  - From representative number bldg / plume area
- Several major issues remain to be decided upon

#1 Critical Policy Issue
Delineation of Problem/MDL/MCL

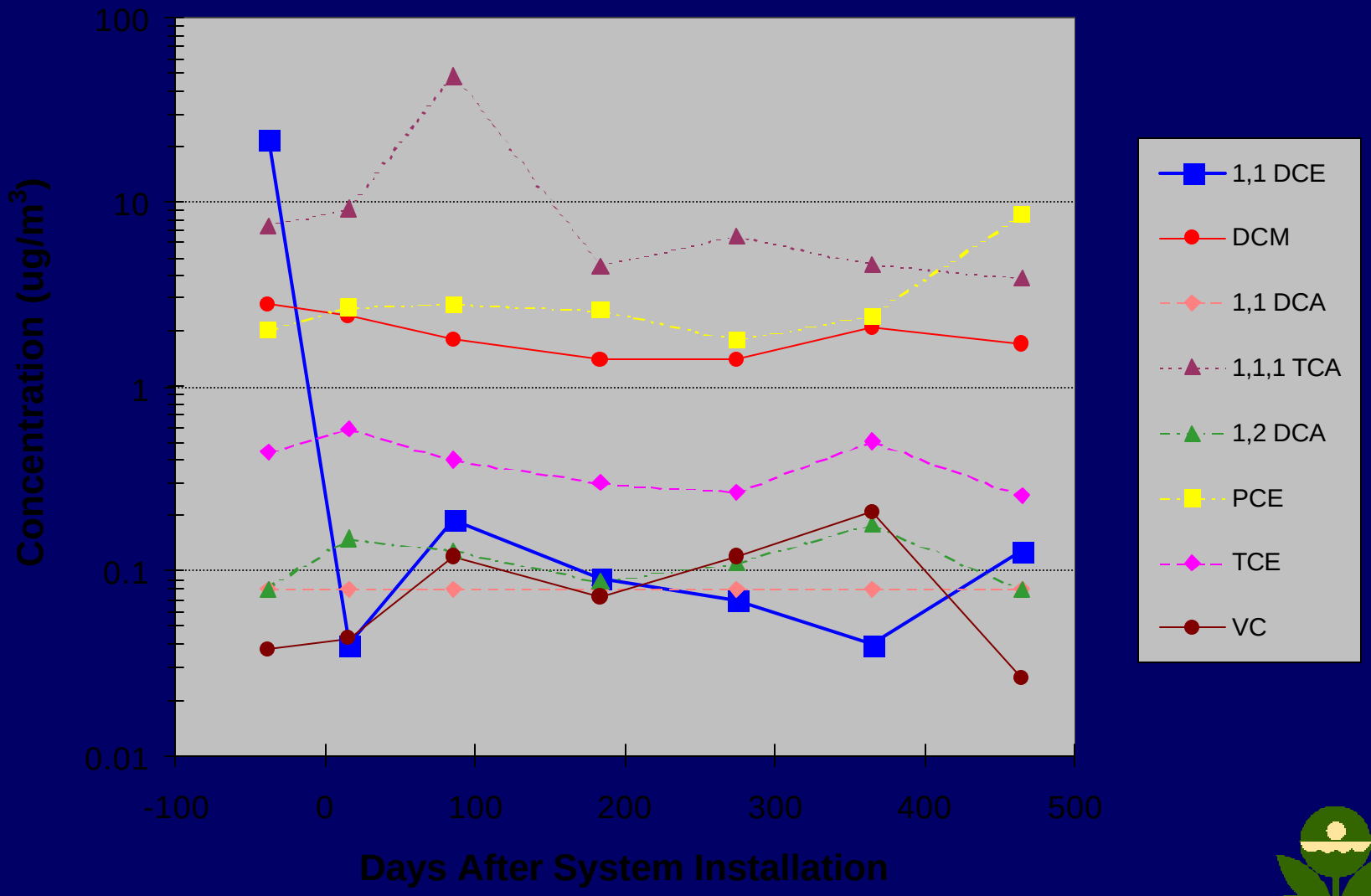
- Theoretical concerns for potential risks with:
  - Groundwater (soil-gas, or air) concentrations:
    - < Max. Conc. Limit (MCL) (current)
    - < Min. Detection Limit (MDL) (current) [so are RBCs]
- Field evidence of problems <MCL very limited
  - appearances may be explainable via preferential pathways from higher-level sources (see Redfld)
- Very difficult to justify new groundwater characterization as necessary at this time to identify new problem areas
- Proposal = Use current plume delineation*
  - *Except where non- (>>) drinking water "stds" were used

#2 Critical Policy Issue
"Background" Concentrations

- Man-made "background" sources:
  - Outdoor (Ambient) Air:
    - Numerous stationary and mobile sources of air toxics
    - Enormous Agency effort to reduce air toxics loading
      - Some outdoor contaminants from same facility as gw plume
  - Indoor Air:
    - Numerous indoor consumer-product sources of air toxics
    - Significant Agency effort to reduce air toxic in indoor air (big)
      - Contribution from tap water supply at MCL?
  - Other lifestyle / activity / short-term sources:
    - Numerous workplace exposures (with much higher levels)
    - Numerous hobby & maintenance (e.g., painting, lawn mowing) activities, visiting dry-cleaners, pumping gas, finger nail polish
- Human body integrates all sources (limits?)


270
TCE Maximum Conc.
All Indoor Air Data
(9/24/97 — 12/31/99)
Red Bars are outliers/NGWS
Values > 5.0 are labled

BACKGROUND VOC LEVELS IN MITIGATED HOMES



What is an acceptable level of (additional) risk for VOC exposures from soil gas?

- Should we accept HIGHER risk levels for indoor air exposures (from soil-gas sources) [than from soil or groundwater exposures]?
- Or, LOWER than normal risk levels?
- Because:
  - **many receptors are already exposed** to significant levels in indoor air (and other personal exposures)
  - And what would the public think?

- Slide from Aug. 15, 2000 EI Forum 7pm presentation

Comparison of Personal and Subsurface Exposures

(Position 1 - "Should not significantly increase")

- Direct comparison - (adding) - assumes risks are the same
- However, the exposures and risks are different, e.g.,:

Personal VOC Pollution	SubsurfaceVOC Vapor Intrusion
Voluntary	Involuntary
Awareness	No awareness
Implicit acceptance	No permission
Assumed benefits	No benefits
Personally controllable	Not readily controllable
Personally responsible	Not responsible

- all important elements in the definition of "acceptable" risks

Man-made "Background"

What is the best way to handle Critical Policy Issue #2

- Our responsibility is RCRA regulated (typically only sub-surface) contribution
- One position taken sometimes is :
  - Only concerned if > doubling "background" levels? (i.e., if subsurface component > "background")
- Incremental risk policy
  - doesn't raise or lower acceptable limits based on pre-existing "background" levels
  - Allows these exposures to be treated similarly to soil and groundwater
  - Incremental risk policy is an intermediate position

Other Policies yet to be Decided (What is the best way to handle them?)

- **Petroleum/Biodegradable Compounds (#3)**
  - Biodegradation is well documented, but here?
  - Prediction of biodegradation is not ready yet
  - Don't want to waste a lot of unnecessary time on sites that don't present real risks (when others do)
- **Non-residential exposures (#4)**
  - Environmental vs Workplace exposures
  - Occupational Exposure Levels inappropriate- EPA
  - Role of awareness & acceptance of de-minimus incremental risks needs to be considered carefully
  - Particularly for workers with similarly toxic exposures who are notified (and aware) of incremental subsurface contributions